lution yielded a precipitate of the white sulphide upon the addition of a dilute acid. When this sulphide, GeS_2, was heated in a current of hydrogen, small glittering scales of the lower sulphide, GeS, much resembling crystals of specular iron ore, were formed just beyond the heated portion of the tube; upon continued heating complete reduction occurred, metallic germanium itself being deposited upon the walls of the tube in small greyish-white octahedral crystals which exhibited a particularly brilliant metallic lustre.

Canfieldite, upon analysis, yields numbers which indicate that its composition is Ag_8GeS_6, or $4Ag_2S.GeS_2$. Prof. Penfield points out that the published analysis of Prof. Winkler's for *argyrodite* agrees much better with the same formula than with the formula $3Ag_2S.GeS_2$, which he ascribes to it in his memoir. Prof. Penfield confirms this by another analysis of *argyrodite* conducted with an excellent specimen in his possession. The two minerals would thus appear to possess the same composition. They are not identical, however, for *argyrodite* crystallises in the monoclinic system. *Canfieldite* crystallises in cubic octahedrons modified by dodecahedral faces; the crystals are black with a blue or purple sheen, they exhibit a magnificent metallic lustre and are extremely brittle. *Argyrodite* and *canfieldite* are therefore dimorphous forms of silver germanium sulphide.

NOTES from the Marine Biological Station, Plymouth.—Last week's captures include the Hydroid *Myriothela phrygia*, the semi-parasitic Rhabdocœle *Fecampia erythrocephala*, and the Mollusca *Favorinus albus* and *Rostanga coccinea*. The floating fauna has changed very slightly since last week, but several other autumn forms have made their appearance. Radiolaria have been present in fair numbers; the Anthomedusa *Podocoryne* (= *Dysmorphosa*) *carnea* has been plentiful, the majority possessing buds upon the manubrium; and the beautiful larvæ of the Prosobranch *Rissoa* and of the Opisthobranch *Ægirus punctilucens* have also been taken. The Turbellaria *Fecampia erythrocephala* and *Cycloporus papillosus*, and the Crustacean *Hyas coarctatus* are now breeding.

THE additions to the Zoological Society's Gardens during the past week include two Ruffed Lemurs (*Lemur varius*, ♂ ♀) from Madagascar, presented by Mrs. Brightwen; three Long-eared Owls (*Asio otus*) and one Tawny Owl (*Syrnium aluco*) from Europe, presented by Mr. Edmund Hart, F.Z.S.; a —— Falcon (*Falco* ——) from ——, presented by Lord Lilford, F.Z.S.; five shags (*Phalacrocorax graculus*) from Scotland, presented by the Maclaine of Lochbuie; a Common Chameleon (*Chamæleon vulgaris*) from North Africa, presented by Mr. E. Palmer; a Black-headed Caique (*Caica melanocephala*) from Demerara, deposited; a Regent Bird (*Sericulus melinus*) from Australia, purchased.

OUR ASTRONOMICAL COLUMN.

THE ORIGIN OF NEW STARS.—Prof. A. W. Bickerton writes to us from Christchurch, New Zealand, as follows:—"More than a year has elapsed since the first notice appeared of the new star in Aurigæ, and up to date no generally-accepted explanation of the special phenomena noted has been offered in any of the leading journals. May I beg to draw the attention of your readers to several articles bearing directly upon the mode of origin of new stars, published fifteen years ago in the Transactions of the N.Z. Institute? The explanation there offered appears to fit in almost exactly with the actual conditions as observed in this particular case. The papers referred to are contained in vols. 11, 12, and 13 of the Transactions of the N.Z. Institute. A summary of these papers also appears in the Proceedings of the Australasian Association for the Advancement of Science for the year 1891." Upon referring to the above references we find that Prof. Bickerton believes that new stars are caused by the "grazing" collision of stars like the sun. His researches show that "The temperature developed is independent of the amount of grazing. With similar substances it depends only on the velocity destroyed, so that the coalesced body produced by the merest graze must be as hot as though the whole sun collided. The molecular velocity of such a high temperature may be sufficient to carry away every particle entirely into space, the mass of the body not having sufficient attractive power to retain them. Hence an intensely brilliant body is produced in less than an hour; it then expands and increases in size and total luminosity for perhaps a few hours to a day or so; then the diffusion would be so great as to gradually lessen luminosity, until in a few months or a year the star would have disappeared into space. This represents all the peculiarities of temporary stars. If the graze be more considerable the attraction will be greater, yet the molecular velocity is the same: a hollow globe of gas may then result, giving us a planetary nebula. According to Lord Lindsay this is the condition of the temporary star in the Swan."

THE SPECTRUM OF THE RORDAME-QUÉNISSET COMET.—Prof. Campbell in *Astronomische Nachrichten*, No. 3177, gives a detailed account of the visual and photographic observations that he has made of the spectrum of this comet at the Lick Observatory. The following are the visual observations, and in the fourth column are given Kayser and Runge's wave-lengths for the edges of carbon bands.

July 11.	July 12.	July 17.	Carbon bands.	Description of bright lines and bands.
600	601	—	619·595	Maximum of red band, broad, faint.
562	—	—	563	Red edge of yellow band.
—	—	5633	5635	Very faint line terminating in yellow band.
—	—	558	5585	Bright line in yellow band.
5162·1	5161·8	5163·9	5165·2	Very bright line terminating in green band.
5124	5127	5128	5129	Very bright line terminating in green band.
—	—	509	—	Very bright line terminating in green band.
4734	—	—	4737	Red edge of blue band.
—	—	4734	4737	Bright line terminating blue band.
—	434	—	—	Bright region in continuous spectrum, faint.
—	421	—	—	Bright region in continuous spectrum, faint.

In addition Prof. Campbell has obtained two photographs of the comet-spectrum extending from wave-length 487 to 387. Twenty-eight bright lines have had their positions determined in the photographic spectrum, fourteen of which appear to correspond to lines and bands of carbon and cyanogen as given by Kayser and Runge. It is pointed out, however, that the wave-lengths of the comet-lines are systematically less than Kayser and Runge's by one or two tenth-metres. Prof. Campbell thinks this may in part be due to the fact that the cometary spectrum consists of unsymmetrical bands rather than lines, and partly to motion in the line of sight.

ATMOSPHERIC REFRACTION AND STAR PHOTOGRAPHS.—Now that stellar parallax is determined from photographic data, and a catalogue of stars is being prepared from the images impressed by celestial points upon sensitive films, it becomes necessary to investigate the effect of each and every cause tending to vitiate the results. Prof. A. A. Rambaut considers the most important of these disturbing causes in a paper on the distortion of photographic star images due to refraction read before the Royal Dublin Society on April 19, and just published in a separate form. Prof. Rambaut had previously published formulæ (*Astr. Nach.* 3125), by which the correction for refraction to the relative position of any two stars on a photographic plate can be computed in a convenient manner, and he has now followed these up by determining the distortion that takes place in the shape of a star-image during the exposure. His conclusion is that within the limits of an exposure of fifteen minutes' duration, "so long as the zenith distance does not exceed 60° no sensible error can arise through the distortion of a star by refraction if the measures are in all cases made from the centre of the image, and the coefficients in the formulæ of reduction are computed for the time corresponding to the middle

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of the exposure, but if photographs obtained with longer exposures are utilised for the determination of the relative position of stars, it will be necessary to know what star on the plate was used as guider, and the distortion by refraction must be investigated for all stars at any considerable distance from it." From this it will be seen that the photographs of stars obtained for the determination of parallax, or in connection with the star catalogue, are unaffected by the result, since the exposure in each case is usually less than the limit defined by Prof. Rambaut.

ASTRONOMY POPULARISED.—We have previously referred to a proposal to issue a new astronomical periodical, designed for amateurs, teachers, students of astronomy, and the public generally. The first number of this *Popular Astronomy* will be published about September 1, by Mr. W. W. Payne, Goodsell Observatory, Carleton College, Northfield, Minn., U.S. Messrs. William Wesley and Son, 28 Essex Street, Strand, London, are the agents for England. The periodical will be issued monthly, but no numbers will be published for July and August of each year. One of the features will be a scheme of work suitable for a small telescope, field glass, opera glass, and the naked eye. Those who wish to know their way about the sky will find their wants supplied, and home readers will be catered for by means of lists of best books and schemes of study. From these and other matters mentioned in the prospectus it seems probable that the periodical will possess the features that command success.

COMET APPEARANCES IN THE YEAR 1892.—Prof. H. Kreutz has collected together all the appearances of comets during the past year, this list appearing in the *Vierteljahrschrift der Astronomischen Gesellschaft*, 28 jahrgang, parts 1 and 2. In addition to short descriptions of the appearances put on by them at the times of discovery, and to the values of the elements of the new ones, he gives references to all the observations that have been made of them. Among those that receive more than usual attention are Comet 1892 I., discovered by Swift; Comet Holmes (1892 III.), Winneike's Comet (1892 IV.), and Comet 1892 V. (Barnard), since it was the first (excluding that photographed in the Solar Eclipse of May 17, 1882) discovered by photography.

GEOGRAPHICAL NOTES.

THE Society for the study of French Congo has organised a strongly-manned expedition to survey the valley of the Kuilu and Niadi rivers, in order to ascertain the feasibility of constructing a railway from the coast town of Loango to Brazzaville on Stanley Pool. A geological and botanical staff accompany the survey party, and the whole is under the command of M. A. Le Châtelier, who, with fifteen French members of the expedition, sailed from Marseilles last week.

RUSSIAN authorities are determined this year to test the capabilities of the Kara Sea route to Northern Siberia. A small fleet of three vessels, specially built on the Clyde for navigation on the Upper Yenesei, has recently set out in charge of Russian naval officers, who are confident of making a rapid journey. Capt. Wiggins is also in charge of some vessels laden with railway material for the great trans-Siberian line, which are now on their way to the Kara Sea. Dr. Nansen, in the *Fram*, must now be very near the entrance to the Kara Sea, and the nature of the ice there will determine which of the three routes into the sea will be attempted. The ultimate establishment of a commercial steamer service is only a matter of money.

IN a racy little pamphlet, *La Géographies dans les Chaires de l'Université*, Dr. Maurice Viguier makes a raid on a number of elementary text-books published by the leading geographical professors of Paris, and he succeeds in showing many errors of statement which should be set right. He goes on to argue that the inaccuracy of these popular schoolbooks, written to satisfy an arbitrary syllabus, proves the geographical incompetence of the authors. Few eminent men in any country could stand such a test, and in truth the faults cited and held up to ridicule so cleverly are faults of composition rather than of fact, and the worst are due to the ambiguity of words in common speech.

PRELIMINARY arrangements are being made for the meeting of the Sixth International Geographical Congress in London in 1895. This congress will be under the patronage of the Queen, and will bring together the geographers from all countries for the discussion of questions in which the international or universal side of geography will be kept to the front. The month of the proposed meeting has not yet been fixed.

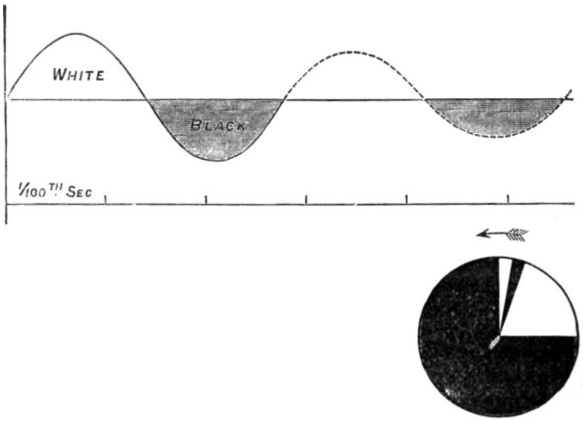
THE Central African telegraph line, projected by Mr. Cecil Rhodes, has been already commenced, and contracts have been signed for its construction from Fort Salisbury as far as Lake Nyasa. The wire will be carried on iron poles, and taken across the Zambesi (a distance of about half a mile) overhead at a height sufficient to allow the traffic on the river to pass entirely unimpeded. The advantage of this line in bringing the region of the great lakes into telegraphic touch with Europe will be very great.

CHARPENTIER'S EXPERIMENTS DEMONSTRATIVE OF AN OSCILLATORY PROCESS IN THE ORGAN OF VISION AND OF ITS DIMENSIONS.

ONE of the fundamental positions in Hering's physiological theory of visual sensation is that each sensificatory datum diffuses in the retino-cerebral organ beyond its precise locus of incidence, and thus directly modifies contiguous sensificatory data. A very elegant experimental substantiation of this position is contained in two simple optical observations by Charpentier[1] (of Nancy) giving not only the clearest possible demonstration of the fact itself, but an approximate measure of the physiological duration and velocity of the phenomenon.

These experiments are (1) that of the "black sector," demonstrative of a retino-cerebral oscillation; (2) that of the "fluted band," demonstrative of the propagation of that oscillation.

(1) *Charpentier's experiment of the Black Sector.*—A black disc with a white quadrant, revolving once in two seconds, illuminated by a very bright light (preferably direct sunlight). Observer's eye fixed upon centre of disc. A narrow black sector appears on the white quadrant near the receding edge of the black surface. This is interpretable as a rebound effect indicative of an oscillatory process in the retino-cerebral organ; the first effect at the arrival of the white border is the sensation of white, and this first effect is followed by an after-effect that is black. On closer examination it may be noticed that the angular breadth of the black sector is equal to the breadth of the white interval between it and the receding black border, and that these breadths increase and diminish with increase and diminution in the speed of revolution; estimating from this speed and from the apparent extent and position of the black band, Charpentier finds that the white phase and the black phase have each a duration of ·014 to ·016 second, *i.e.* that a total oscillation of the two phases lasts ·028 to ·032 second, *i.e.* that the oscillation frequency is 36 to 31 per second.



Nothing can be clearer and more striking than this experiment; provided a strong light is used, it can be roughly demonstrated without any elaborate apparatus; it can be done by a black and white disc slowly turned round by hand, or by a

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[1] *Comptes Rendus*, Soc. Biol., Mai 16, 23, 30, 1891. *Comptes Rendus*, Acad. Sc., Juillet 27, 1891. *Arch. de Physiol.*, Juillet et Octobre, 1892.

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